Description of Tasmanian Mud Trout, Galaxias (Galaxias) upcheri sp. nov.: With a Note on the Genus Brachygalaxias Eigenmann, 1924, and its Occurrence in Australia

By E. O. G. Scott

Plate X

Abstract

A Galaxiid from Dover, South Eastern Tasmania, known locally as Mud Trout, specimens of which have been secured for the Museum by Mr P. R. Upcher, proves to be an undescribed form: it is here described and figured as *Galaxias (Galaxias) upcheri sp. nov.*

The status of *Brachygalaxias* Eigenmann, 1924 is discussed, and some new evidence of its distinctness from *Galaxias* Cuvier, 1817, based on myotome-counts, is adduced: *Galaxias pusillus* Mack, 1936 from Victoria is referred to *Brachygalaxias*, previously known to occur only in South America.

Attention is called to a recent *lapsus calami* involving a confusion of two Galaxiid genera.

Family GALAXIIDAE

Genus **Galaxias** Cuvier, 1817

Galaxias (Galaxias) upcheri *sp. nov.*

(Plate X)

Diagnosis. A *Galaxias s. str.*, with entopterygoidal teeth and seven-rayed pelvic; but manifesting, in reduced number of entopterygoidal teeth, small size of pelvic, low dorsal, and rounded caudal some approach to the subgenus *Saxilaga* Scott, 1936. Distinguished trenchantly from all Australian species of the subgenus *Galaxias* by rounded caudal, height of dorsal less than (or subequal to) its base, projecting lower jaw; and differing from *G. (G.) prognathus* Stokell, 1940, from New Zealand, which is its nearest ally, in having rounded caudal, larger mouth, dorsal base $1\frac{2}{3}$-$1\frac{3}{4}$ (in *G. (G.) prognathus* more than 2) in postorbital portion of standard length. Found in mud and moist earth, D'Entrecasteaux Channel region, Tasmania. Standard length of largest specimen examined 61·0 mm.

Description. B. 9 (9-11). D. IV, 7 (III-V, 7-8). A. IV, 9 (III-IV, 9). P. 14 (13-15). C. 14, II-V (IV-VIII) superior, VIII (III-VIII) inferior, procurrent rays. Gill-rakers on lower limb of anterior arch 7 (7-8), fairly slender, bluntly pointed.

Depth of body 8·2 (8·2-10·4) in total length, 7·3 (7·3-9·0) in standard length. Head 6·4 (5·9-6·7) in total length, 5·7 (5·1-6·0) in standard length. Snout 4·2 (3·9-4·2) in head. Eye 1·4 (1·2-1·5) in snout, 2·2 (2·0-2·5) in interorbital width, 5·9 (5·2-6·2) in head. Depth of caudal peduncle 1·7 (1·4-1·7) in its length, 2·2 (2·2-2·5) in head. Length of caudal peduncle 1·4 (1·3-1·4) in its superior length, 1·4 (1·1-1·4) times base of dorsal.

Body slender, subcylindrical (slightly compressed); greatest width 1·3 (1·1-1·3) in greatest depth. Head rather small, scarcely marked off from body; greatest depth 1·0 (0·9-1·1) in greatest width; depth at eyes 1·4 (1·1-1·4) in width there, the latter dimension being 1·1 (1·1-1·3) times postorbital portion of head. Eye small. Interorbital region almost flat. Snout obtuse, little depressed; lower jaw decidedly (decidedly-slightly) projecting beyond upper. Mouth small, oblique; maxillary extending to level of anterior $\frac{1}{6}$ (anterior $\frac{1}{10}$-$\frac{1}{4}$) of eye. Tubular anterior nostril rather wider than high: nearer to anterior margin of upper lip than to eye. Simple posterior nostril somewhat transversely lunate, about level with (in some paratypes slightly above, and slightly in advance of) superior and anterior borders of eye; about 4 (4-6) times as far from anterior nostril as from orbit.

Head with pores of three sizes. Pores along midlateral line about 38 to level of vent, in general one to each myomere; behind the level of the vent, where there are about 20 myomeres, the pores are not countable with certainty.

Lingual teeth in 2 series of 4; large, acute, recurved. Entopterygoidal teeth small; a short series of about 4 on each bone. Premaxillary teeth long, slender, subconical, gently curved backwards; none caniniform; the whole series of about 15 on each side decreasing slightly and evenly in size backwards. Mandibular teeth long, slender, subconical, gently curved backward; about 17 in each ramus, subequal except at the posterior end of the series, where they are smaller.

Dorsal fin moderate, low, its vertical height decidedly less than its base; most of the rays feebly branched, or simply cleft in their distal one-third; base 1·9 (1·7-1·9) in head, slightly less than (in 3 paratypes slightly in excess of) postorbital portion of head; longest (3rd (3rd-4th) branched) ray 1·7 (1·5-1·7) in head, 1·1 (larger paratypes 0·9-1·0; smaller paratypes 1·1-1·3) in base of fin; distance from its origin to base of caudal 3·6 (3·5-3·7) in standard length; laid back, extends rather more than one-third of distance to base of caudal, not, or barely, reaching to origin of caudal ridge.

Anal fin slightly longer than dorsal, equal in height to, or slightly lower than, that fin; most of the rays barely branched, cleft in their distal one-third; base 1·5 (1·4-1·6) in head, less than (in 2 paratypes, slightly in excess of) caudal peduncle; longest (3rd (3rd-4th) branched) ray 1·8 (1·5-1·8) in head, subequal to depth of head; originating behind origin of dorsal by 0·3 (0·2-0·3) of dorsal base; terminating behind dorsal by 0·5 (0·4-0·5) of dorsal base; laid back, extends slightly less (slightly less-slightly more) than half-away along caudal peduncle, reaching a little beyond origin of caudal ridge.

Pectoral fin small, rounded; longest (7th (7th-8th)) ray 1·5 (1·5-2·0) in head; extending 0·3 (0·3-0·4) of distance from its origin to origin of pelvic.

Pelvic fin small; longest (4th) ray 2·1 (2·1-2·6) in head; originating midway between base of caudal and anterior margin of orbit (anterior nostril to anterior

¼ of eye); length to its origin 1·9 (1·9-2·0) in standard length; extending 0·3 (0·3-0·4) of distance from its origin to origin of anal, the amount of extension inversely proportional to standard length.

Caudal fin moderate, gently rounded; length 1·4 (1·2-1·5) in head, rather more than twice depth of caudal peduncle. Caudal ridges well developed; total depth at level of hypural greater than, or equal to, twice snout.

Total length 63·5 mm. (50·0-68·5 mm.); standard length 56·5 mm. (43·3-61·0 mm.).

Ground colour in alcohol light yellowish, slightly paler beneath. Sides of body barred and blotched with brown; in advance of anal origin about twelve to fourteen fairly regular bars, often somewhat sinuous, but in general in the form of forwardly directed chevrons with apex near midlateral line, their interspaces commonly rather less than their width (considerable variation in this point in individuals and, at times, in different parts of same individual); behind anal origin the bars lose their integrity, by developing irregular lobate ramifications (adjacent bars may thus anastomose), by breaking up into blotches, or, more commonly, by a combination of these two processes. A row of about a dozen small dark spots along either side of base of dorsal fin, usually continuing, in rather less definite form, along upper margin of body to base of caudal: no such rows along base of anal. Dorsal surface irregularly barred and blotched by continuations of the lateral markings: small dark spots in two somewhat irregular rows, sometimes becoming a single staggered row posteriorly, along middle of back. Ventral surface macroscopically immaculate, minutely and very sparsely punctulated with brownish. Head in general concolorous with body: dorsal surface heavily and regularly dotted with brown, the dots a little larger towards tip of snout; a triangular region, whose base embraces eyes, and whose vertex about reaches occiput, decidedly darker than rest of head: sides with numerous minute dark dots; usually a lighter region on cheek, and always an obscure darkish blotch on operculum; ventral surface yellowish, faintly peppered with brownish; lips about concolorous with snout, or a shade darker, the punctulations smaller, more crowded; a few larger markings add, in some specimens, a definite duskiness. Iris dark bluish. No suborbital dark streak.

Dorsal and anal fins hyaline, faintly greenish: delicate brown peppering at base causes a slight duskiness, and, in the dorsal of several specimens, gives rise to two or three small obscure brownish spots. Pectoral and pelvic fins of lighter individuals virtually colourless, of darker specimens somewhat dusky greenish, particularly towards tips of rays. Caudal fin varying from almost colourless to fairly dark greenish brown, always darkest basally: in several specimens a tendency towards the formation of dark arcs, running vertically, on basal half of fin. Caudal ridges greenish yellow, occasionally with several indefinite dark ferrugineous spots.

Specific name in honour of Mr P. R. Upcher, Dover, by whom the specimens were collected.

Types. Described from the holotype (figured in Plate X) in the Queen Victoria Museum, Launceston (Reg. No. 1940. 361: 1), of standard length 56·5 mm., total length 63·5 mm.; and from seven paratypes, of standard length 43·3-61·0 mm., total length 50·0-68·5 mm., the variations in fin-counts and proportions exhibited by which are noted throughout in brackets. Paratypes will be offered to the British Museum (Natural History, London); Australian Institute of Anatomy, Canberra; Australian Museum, Sydney; National Museum, Melbourne; Museum of Zoology of the University of Michigan, Ann Arbor, U.S.A.

Locality. Dover, South Eastern Tasmania; in swampy country.

Habits. I am indebted to Mr W. Manson, Chief Chemist and Metallurgist, Mines Department, Launceston, for bringing under my notice the existence of a small fish found in mud and moist earth in the D'Entrecasteaux Channel region. At Mr Manson's suggestion I communicated with Mr Peter R. Upcher, *Fritton*, Dover, who kindly secured specimens for the Museum. In a letter dated 15th April, 1936, Mr Upcher supplies some notes on the habits of this species. 'The local name given to the fish is "Mud Trout" or "Muddy". It is much prized as the most effective bait for Brown Trout during the early part of the season. It is found in swampy Ti-tree country, and in dry periods can be found thriving in quite thick mud. I gave it the name of "Lung Fish" on account of the long period it can live out of water, and the smallness of both mouth and gills . . . I have known' a specimen of this hardy little fish 'to be drawn about through the water with a hook through his lip for half an hour or more, and be quite alive and well for the next week-end's fishing'.

Affinities. From all Tasmanian and Australian species of *Galaxias*, *G. (G.) upcheri* is trenchantly marked off by *(a)* rounded caudal; *(b)* low dorsal fin, with vertical height decidedly less than (longest ray subequal to) basal length; *(c)* projecting lower jaw. In features *(b)* and *(c)* it approaches the New Zealand *G. prognathus* Stokell, 1940 [1], from which it is recognized by its convex caudal, larger mouth, dorsal base $1\frac{2}{3}$-$1\frac{3}{4}$ (in *G. prognathus* more than 2) in postdorsal portion of standard length.

From Tasmanian species with more or less similar colour-pattern *G. (G.) upcheri* may be distinguished thus: from *G. (G.) parkeri* Scott, 1936 by smaller pelvic, smaller pectoral, smaller eye, more anterior origin of anal relative to origin of dorsal; from *G. (G.) johnstoni* Scott, 1936 by same four characters, also by fewer anal rays; from *G. (G.) weedoni* Johnston, 1883 by same four characters, also by more slender caudal peduncle. Anal-dorsal index [2] = 10·0-13·0 (*cf.* *G. (G.) parkeri* 13·6-24·0; *G. (G.) johnstoni* 24·0-30·0; *G. (G.) weedoni*, as determined from figure by Regan (1906), 18·8).

Though a true *Galaxias*, with entopterygoidal teeth and seven-rayed pelvics, this species manifests in reduced number of the former and small size of the latter some approach towards *Saxilaga* Scott, 1936: it further resembles the two Tasmanian and one New Zealand species of that genus in its low vertical fins (vertical

(1) Taxonomic problems raised by this species, which exhibits a remarkable variation in number of pelvic rays from 6 to 8, will be discussed at a later date: the rejection by Stokell (1940), on account of this variation, of subgeneric divisions of *Galaxias* proposed in a previous paper (Scott, 1936) calls, however, for brief comment here. In the first place, it should be recognized that two distinct problems are involved: *(a)* the classification of *Galaxias prognathus*; *(b)* the validity of certain subgenera of *Galaxias*. As regards *(a)*, it is obvious, as Stokell points out, that *G. prognathus*, with 6-8 pelvic rays (the counts often varying in two fins of the same individual), cannot be relegated to one of several subgenera, at present characterized solely by number of pelvic rays: it is equally true, as Stokell fails to remark, that a fish with 8 pelvic rays cannot enter *Galaxias* at all, as the genus is at present recognized. The position is, of course, that, in this particular species, a character hitherto found usefully diagnostic is in an unstable condition: and Stokell rightly refers the fish to *Galaxias*, not on account of, but in spite of, its number of pelvic rays. As regards *(b)*, therefore, it is evident that the diagnoses both of the genus *Galaxias* itself and of its proposed subgenera will need to be extended to cover this and similar instances. This extension, while in a sense only of secondary importance in the case of the genus *Galaxias*, is admittedly vital in the case of the subgenera, hitherto defined solely on number of pelvic rays: it is accordingly proposed in a future communication to extend subgeneric diagnoses to meet the position that has thus arisen.

(2) Anal-dorsal index $= \dfrac{A - D}{(d - D)\ (a - A)} \times 100$: where D, d denote, respectively, length to origin, and to termination, of base of dorsal; A, a, respectively, length to origin, and to termination, of base of anal. This index, a modification of a fin-index introduced by Schmidt (1928) for eels, is of considerable diagnostic value in the Galaxiidae (Scott, 1936).

height-base ratio less than unity in *Saxilaga*) and rounded caudal. It is probable all, or most, of these features are related to a habit of burrowing in mud: and we may conjecture that the genotype of *Galaxias*, the present species, the South African *Galaxias (Agalaxias)*, the Tasmanian *Saxilaga (Saxilaga)*, the New Zealand *Saxilaga (Lixagasa)*, and the New Zealand genus *Neochanna* represent, in that order, not indeed a genetic, but a morphological, series, extending between extremes of, at one end, well-developed entopterygoidal teeth, well-developed pelvics, short, high dorsal and anal, well separated from caudal, large eye, emarginate caudal, free-swimming habit, and, at the other end, no teeth on palate, no pelvic fins, long, low dorsal and anal, more or less confluent with caudal, small eye, convex caudal, burrowing habit.

Genus **Saxilaga** Scott, 1936

Subgenus **Lixagasa** Scott, 1936

Saxilaga (Lixagasa) burrowsius (Phillipps, 1936)

Galaxias burrowsius Phillipps, *Trans. N.Z. Inst.*, 56, 1936, p. 531, pl. 88.
Galaxias burrowsii Phillipps, *Journ. Pan-Pacific Res. Inst.*, 2, 1, 1927, p. 11.
Saxilaga (Lixagasa) burrowsius Scott, *Pap. Proc. Roy. Soc. Tasm.*, 1935 (1936), p. 110.
Paragalaxias burrowsii Phillipps, *The Fishes of New Zealand*, vol. 1, 1940, p. 39. *Lapsus calami.*

In order to obviate possible future confusion, attention is here drawn to a recent attribution (Phillipps, 1940) of *Galaxias burrowsius* Phillipps, 1936, apparently by a *lapsus calami*, to the genus *Paragalaxias*.

Paragalaxias, for the reception of which a subfamily, *Paragalaxiinae*, has been proposed, differs at sight from all other Galaxiid genera in having the dorsal fin well forward, about over pelvic fins. (In the diagnosis of the genus (Scott, 1936, p. 111) the position is correctly given, but in the diagnosis of the family (p. 110) the relevant passage reads 'Dorsal fin inserted well back, about over pelvic fins', in which, as is evident from the context, 'back' unfortunately appears, in error, for 'forward'). *Saxilaga*—to a subgenus *(Lixagasa)* of which *Galaxias burrowsius* Phillipps has been referred (Scott, 1936, p. 110)—has the dorsal in the normal Galaxiid position, namely, partly over anal, the genus being established to include species differing from typical *Galaxias* Cuvier chiefly in lacking teeth on the entopterygoids, and in exhibiting in general a more Neochannoid facies.

Genus **Brachygalaxias** Eigenmann, 1924

Brachygalaxias pusillus (Mack, 1936)

Galaxias pusillus Mack, *Mem. Nat. Mus. Melbourne*, 9, 1936, p. 101.
Galaxias pucillus Mack, *Mem. Nat. Mus. Melbourne*, 9, 1936 (misprint in legend of fig. 2, p. 101).
Galaxias ornatus Whitley, *Rec. Aust. Mus. Sydney*, xx, 4, 1939, p. 268. Not *G. ornatus* Castelnau, 1873.

The description by Mack of a Victorian Galaxiid referable to the South American genus *Brachygalaxias* Eigenmann, 1924 is an event of considerable taxonomic, and no small zoogeographic, interest.

In a brief review of Galaxiid systematics (Scott, 1936) I observed of Eigenmann's genus—which has not by any means been universally accepted: *e.g.*, 'a separate genus does not seem warranted' (Mack, 1936)—that, on number of pelvic rays alone, it might be conveniently accommodated in a tentative key as a subgenus; but added 'it is possible, however, that the two main characters [pelvic five-rayed, anal origin anterior to dorsal origin] noted by Regan (1908) as distinguishing' his *G. bullocki*, orthotype of *Brachygalaxias*, 'from all other species, may prove, upon further consideration, to be worthy, when regarded in combination, of generic recognition'.

It is of much interest to find that the Australian species agrees with the genotype in at least six important described features: *(a)* pelvic with fewer than 7 rays; *(b)* anal inserted partly in front of dorsal; *(c)* vent located about at beginning of last third of standard length; *(d)* small size (Eigenmann notes *B. bullocki* is the smallest of the Galaxiidae in Chile, and the maximum total length among his five series and the 'numerous examples' of Regan (1908) is 60 mm.; holotype of *B. pusillus* 31 mm.); *(e)* large eye (*B. bullocki* 3·5-3·3, *B. pusillus* 3·0, in head); *(f)* longitudinal colour-pattern ('a broad orange longitudinal band along side' in *B. bullocki*, three longitudinal dark lines on flank in *B. pusillus*).

An additional point of importance, regarding which no published information appears to be available in descriptions or figures, is *(g)* number of myomeres. Having long thought it possible the 'short body' of *Brachygalaxias* might be susceptible of more precise specification, I recently took an opportunity of examining Regan's type-material in the British Museum, Natural History. I find in *B. bullocki* there are, approximately, 10 myomeres from pectoral base to pelvic origin + 9 to anal origin + 4 to dorsal origin + 16 to caudal origin = *c.* 39. In a paratype of *Galaxias pusillus* Mack, donated by the National Museum, Melbourne to this institution (Q.V.M. Reg. No. 1940. 212), the corresponding approximate counts are 9 + 9 + 5 + 15 = *c.* 38. On comparing these myomere-counts with those for the genotype of *Galaxias*, *G. (G.) truttaceus* (17 + 19-20 − 2 + 21-22 $\doteq$ 55) and for the most widely distributed species of true *Galaxias*, *G. (G.) attenuatus* (16-17 + 21-22 + 0 + 18 or more $\doteq$ 55), it is evident we are dealing with two very different types of fish as regards body-length expressed in terms of numbers of myomeres.

That the only two Galaxiids known in which the anal originates anteriorly to the dorsal should agree also in such a list of characters, among which *(a)*, *(b)*, *(f)*, *(g)*, and perhaps *(c)* are not found in any other members of the family, appears highly significant. Accordingly, I now adopt the view that *Brachygalaxias* is a well-founded taxonomic unit of full generic status.

In support of a recent identification (Whitley, 1939) of *B. pusillus* as a young stage of *G. ornatus* Castelnau (with which Mack has synonymized *G. findlayi* Regan) I can find no evidence: on the contrary the two fish are widely dissimilar.

The dorsal-anal index, the value of which in *Galaxias* is positive, or (*e.g.*, *G. (G.) attenuatus*) zero, is in *B. bullocki* (Eigenmann's figure) − 23·1, in *B. pusillus* (paratype) − 15·3. The displacement, relative to dorsal origin, of the anal fin cephalad is thus considerable, the dorsal-anal index of *B. pusillus* being of the same order of magnitude as (but of opposite sign to) that of *G. (G.) truttaceus* (Scott, 1936, p. 99).

The two described species of *Brachygalaxias* may be separated by the key given below. (The small number of rays in vertical fins and large mouth noted by Eigenmann (1924, p. 49) in specimens of *B. bullocki* from 'weedy ditch at Cutipai, near Valdivia' suggest the possible existence in this species of local races).

KEY TO SPECIES OF BRACHYGALAXIAS EIGENMANN, 1924

A. Caudal emarginate. Anal base more than one and a half times dorsal base. D. 9 (?8)-12. A. 13 (?12)-18. 'Broad orange longitudinal band along side'. South America .... *B. bullocki*

AA. Caudal rounded. Anal base one and a half times dorsal base. D. 7-8. A. 10-12. In alcohol, side with three narrow longitudinal dark lines. Australia .... *B. pusillus*

REFERENCES

EIGENMANN, C. H., 1924.—The Fresh-water Fishes of Chile. *Mem. Nat. Acad. Sc. Philadelphia*, XXII, 22, 1924.

MACK, G., 1936.—Victorian Species of the Genus *Galaxias*, with Descriptions of Two New Species. *Mem. Nat. Mus. Melbourne*, 9, 1936, pp. 98-101, figs 1-2.

PHILLIPPS, W. J., 1940.—*The Fishes of New Zealand*, vol. 1. New Plymouth, N.Z., 1940.

REGAN, C. T., 1906.—A Revision of the Fishes of the Family Galaxiidae. *Proc. Zool. Soc. London*, 1905, II (1906), pp. 363-384, pl. X-XIII.

————, 1908.—Description of a new Fish of the Genus *Galaxias* from Chile. *Ann. Mag. Nat. Hist.*, (8), I, p. 372.

SCHMIDT, J. S., 1928.—The Fresh-water Eels of Australia . . . *Rec. Aust. Mus. Sydney*, XVI, 4, pp. 179-201, figs 1-14.

SCOTT, E. O. G., 1936.—Observations on Fishes of the Family *Galaxiidae*. Part I. *Pap. Proc. Roy. Soc. Tasm.*, 1935 (1936), pp. 85-112, figs 1-4.

STOKELL, G. P., 1940.—A New Species of *Galaxias*. *Trans. Roy. Soc. N.Z.*, 69, 4, pp. 422-424, pl. 57.

WHITLEY, G. P., 1939.—Studies in Ichthyology. No. 12. *Rec. Aust. Mus. Sydney*, XX, 4, 1939, pp. 264-277, figs 1-3.

Plate X

Tasmanian Mud Trout, Galaxias (Galaxias) upcheri sp. nov.

Holotype (Q.V.M. Reg. No. 1940. 361: 1). Dover, South Eastern Tasmania; in swampy country. Standard length 56·5 mm., total length 63·5 mm. (figure is approximately three and two-fifths times natural size).